

Concept Study Report and Development Effort Proposal for "The Development of X-ray Grating Spectrometers for Future Missions"

Completed Technology Project (2014 - 2018)



Project Introduction

The major goal of this proposal is to develop X-ray reflection gratings for future NASA missions. Off-plane reflection gratings are an innovative technology that is capable of providing an efficient means of obtaining high resolution spectra at soft X-ray energies. Reflection gratings are currently employed in the XMM-Newton Reflection Grating Spectrometer (RGS) while the off-plane mount has been used in suborbital rockets, and studied for Explorer class missions such as the Warm-Hot Intergalactic Medium Explorer (WHIMEx) and future X-ray observatories such as the International X-ray Observatory (IXO), the Advanced X-ray Spectroscopic Imaging Observatory (AXSIO), and the Notional X-ray Grating Spectrometer (N-XGS). Future science goals require higher spatial resolution, higher spectral resolution, and higher throughput to perform the key plasma diagnostics. This translates to a spectral resolving power of 3000 ($\lambda/\Delta\lambda$) and effective area of 1000 cm² over a 0.3-1.5 keV energy range as appropriate performance requirements. An Off-Plane X-ray Grating Spectrometer (OP-XGS) can reach these goals when coupled with a large area, modest resolution telescope. Several spectrometer designs incorporating a ~5-15" telescope followed by an array of off-plane gratings dispersing light onto a CCD camera have been formulated during observatory program studies. We present here a course of effort designed to contribute toward the development of off-plane gratings technologies including fabrication, replication, alignment, and testing. Over the course of a 9 month Concept Study we have identified a novel fabrication technique that we plan to implement during the four year Development Effort. The result will be a high-fidelity off-plane grating capable of achieving the performance requirements of future X-ray missions. We plan to replicate these gratings, align them into a module mount, and performance test the assembly. This work will leverage heavily off of a current NASA Strategic Astrophysics Technology grant and will be critical to the technology development necessary for a recently awarded NASA suborbital rocket program.



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Table of Contents

Project Introduction	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2
Target Destination	2

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

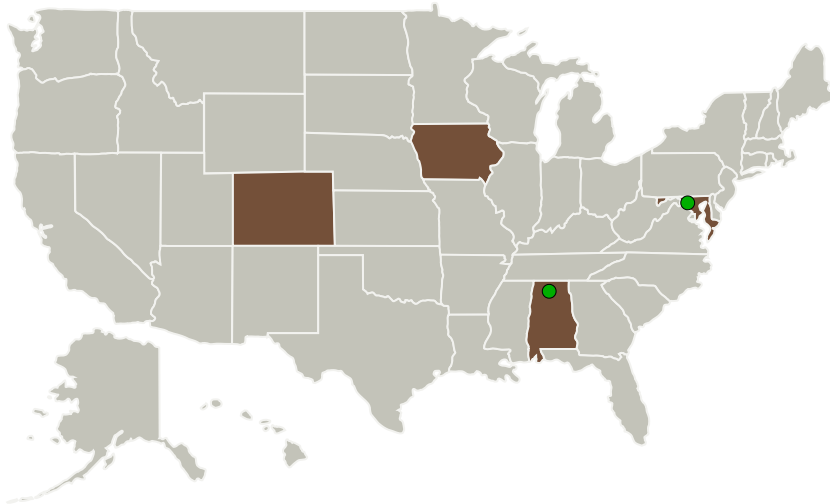
Nancy Grace Roman Technology Fellowship

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Primary U.S. Work Locations and Key Partners



Project Management

Program Director:

Mario R Perez

Program Manager:

Mario R Perez

Principal Investigator:

Randall L Mcentaffer

Co-Investigators:

William W Zhang

Neil J Murray

Webster Cash

Stephen L O'dell

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System

Organizations Performing Work	Role	Type	Location
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
Open University	Supporting Organization	Academia	Milton Keynes, Outside the United States, United Kingdom
University of Colorado Boulder	Supporting Organization	Academia	Boulder, Colorado
University of Iowa	Supporting Organization	Academia	Iowa City, Iowa

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Primary U.S. Work Locations

Alabama	Colorado
Iowa	Maryland